This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

PE
147
A2

B 1,066,528

NORTH CAROLINA GEOLOGICAL SURVEY.

J. A. HOLMES, State Geologist.

BIENNIAL REPORT

OF THE

STATE GEOLOGIST

1893-1894

RALEIGH:
E. M. Uzzell & Co., State Printers and Binders.
1894.

NORTH CAROLINA GEOLOGICAL SURVEY.

J. A. HOLMES, STATE GEOLOGIST.

BIENNIAL REPORT

OF THE

STATE GEOLOGIST

1893–1894

RALEIGH:
E. M. UZZELL & CO., STATE PRINTERS AND BINDERS.
1894.

GEOLOGICAL BOARD.

GOVERNOR ELIAS CARR, *ex officio Chairman*, . . .	Raleigh.
J. TURNER MOREHEAD, ...	Leaksville.
S. L. PATTERSON, ...	Yadkin Valley.
J. A. HOLMES, *State Geologist*, ...	Chapel Hill.

TABLE OF CONTENTS.

	PAGE.
LETTER OF TRANSMITTAL	5
REPORT OF THE STATE GEOLOGIST	7
Iron and Gold Investigations	7
Corundum Investigations	8
Forest Investigations	9
Topographic Work	9
Other Geologic Work	10
Public Road Improvement	10
Coastal Plain Work	11
Stream Measurements	12
Expenditures	13

LETTER OF TRANSMITTAL.

NORTH CAROLINA GEOLOGICAL SURVEY,

RALEIGH, N. C., December 15, 1894.

To His Excellency, GOVERNOR ELIAS CARR,

Raleigh, N. C.

SIR:—I have the honor to submit for your approval and for publication the administrative biennial report of the State Geologist, covering the operations and expenditures of the Geological Survey during the two years ending November 30, 1894.

In this connection I beg to express my appreciation of the active and intelligent interest you have shown in this work throughout the past two years.

With great respect, I have the honor to remain,

Yours truly,

J. A. HOLMES,
State Geologist.

BIENNIAL REPORT OF THE STATE GEOLOGIST ON THE OPERATIONS OF THE NORTH CAROLINA GEOLOGICAL SURVEY DURING THE TWO YEARS ENDING NOVEMBER 30, 1894.

By J. A. Holmes, State Geologist.

The work of the Geological Survey during the two years ending November 30, 1894, including investigations into the gold, iron, corundum, coal and building stone deposits; the examination of the forests and forest lands of the eastern counties, with a short preliminary examination of the mountain sections; topographic surveys of certain local areas in Clay, Jackson, Macon, Orange and Stanly counties; geological investigations of the extreme western and eastern counties; and investigations relating to the occurrence of road materials in the State and methods of road construction. In this work the United States Geological Survey has co-operated with the State Survey, and this has been of considerable value.

IRON AND GOLD INVESTIGATIONS.

The iron and gold investigations have been in charge of Mr. H. B. C. Nitze, Assistant Geologist, with whom has been associated Mr. George F. Becker of the United States Geological Survey, in connection with the work on the gold deposits. The iron ore investigations, including the deposits of magnetite, hematite and limonite iron ores, in all the counties where they are known to occur, which were commenced in 1891, were completed during 1893, and the results have been published as Bulletin No. 1 of the North Carolina Geological Survey, under the title "Iron Ores of North Carolina," by Henry B. C. Nitze, containing 239 pages and 20 plates illustrating the subject.

Mr. Nitze was granted a leave of absence during the winter and early spring months of 1894 in order that he might, in conjunction with the late Dr. George H. Williams in the Geological Laboratory of the Johns Hopkins University, investigate the crystalline rocks

of the Cranberry iron ore region. His work has important economic bearings upon the origin and nature of the Cranberry iron ores. During this time Mr. Nitze was paid no salary by the Geological Survey. He returned to North Carolina on May 12, 1894, and at once began a preliminary field examination of the central gold belts. Late in June he went to the Brindletown region of Burke county and spent the four months following in examining the gold monazite deposits of the South Mountain region in Burke, McDowell, Cleveland and Rutherford counties. During November, in company with Mr. George F. Becker of the United States Geological Survey, he made a hurried examination of the gold belt in the midland counties, and of the Portis mine region of Nash and Halifax counties.

In connection with the gold investigations, Mr. George F. Becker of the United States Geological Survey, and his assistant, Mr. Purinton, came to Charlotte in July, 1904, there arranging a camping outfit, traversed the gold region of the Piedmont counties, thence through Transylvania and other southwestern mountain counties. Later they returned to Charlotte, where during the month of November they were joined by Mr. Nitze and the party made a preliminary examination of the principal gold mines of the midland counties, and in the Nash-Halifax region about the Portis mine.

CORUNDUM INVESTIGATIONS.

The investigation of the corundum deposits has been carried on by Mr. J. V. Lewis, through a field extending from Watauga county south into Georgia, the most important deposit being in Macon and Jackson counties. Dr. George H. Williams of Johns Hopkins University and of the United States Geological Survey, spent two months during the summer of 1893 in the field with Mr. Lewis. During the winter months of 1894, Mr. Lewis made at the laboratories of Johns Hopkins University a careful laboratory examination of the rocks associated with corundum. About the middle of May he resumed the field explorations in Clay, Macon and Jackson counties, and extended the exploration northward through Haywood, Buncombe, Yancey, Mitchell, Watauga and into Ashe county. He was supplied with a traveling outfit consisting of a horse, buckboard and saddle. These investigations will be continued during 1895, and it is expected that

a bulletin on this subject will be ready for publication the latter part of that year.

FOREST INVESTIGATIONS.

Mr. W. W. Ashe, Assistant, in charge of the Forestry Investigations, during the winter and early spring months of 1894 continued the examination of the forest and forest lands of the eastern counties, begun late in 1893. During the summer months he prepared a preliminary report on the Forests, Forest Lands and Forest Products of Eastern North Carolina; Bulletin No. 5 of the North Carolina Geological Survey, 128 pages and 5 plates. He also aided Mr. Gifford Pinchot in the preparation of another preliminary report on the forest trees of the State. He has been granted a leave of absence during the months of October and November, but returns to the work of the Survey in December.

Prof. F. P. Venable, assisted by Mr. Charles Baskerville, has continued to do the chemical work of the Geological Survey, consisting during the present year largely of assays of gold and silver ores.

TOPOGRAPHIC WORK.

Mr. T. R. Foust, aided by Mr. A. H. McFadyen, has at intervals done local topographic work for the Geological Survey in the southeastern part of Orange county, in the vicinity of Lockville, on the Deep river, and in the vicinity of the "Narrows" on the Yadkin river in Stanly county. In the two latter places this work has a bearing on the water-power at these points. Mr. H. Munroe assisted in the water-power investigation in May, making calculations of the areas of drainage basins of rivers west of the Blue Ridge.

Mr. Charles E. Cook, topographer of the United States Geological Survey, came to the State in June, and with two assistants, Mr. J. G. Low and Mr. J. V. Lewis, was engaged during the three months following in making special topographic maps of the important corundum region in Clay, Macon and Jackson counties. During October and November he made a careful survey of the gold and monazite regions of Burke, McDowell, Cleveland and Rutherford counties.

OTHER GEOLOGIC WORK.

Mr. Arthur Keith, Geologist of the United States Geological Survey, with one assistant and camping outfit, spent the months of the summer and autumn seasons in an examination of the general and economic geology of the southwestern mountain counties. During a porton of this time, owing to a deficiency in the government appropriation, his salary and expenses were paid by the State Survey; but during the remainder of the season both were met out of the appropriation made for this purpose by Congress. The geology of this region is exceedingly complex, and the solution of the problems it presents requires a large amount of detail work. But the value of the marble, iron ore, corundum and other mineral deposits is such as to warrant whatever expenditure may be necessary for such investigations. During the months of August, September and October, 1894, Mr. Keith was engaged in making a careful geological survey of the Murphy, Asheville and Cranberry regions.

Professor Collier Cobb of the State University was employed during the summer season in an investigation of the two sandstone belts, one from Anson to Granville counties, and the other on Dan river in Stokes county. Many valuable beds of sandstone were found, and doubtless a number of these will be opened up and quarried for building purposes. The numerous traps or diabase dikes in both these sandstone areas is our best material for road-building purposes. These dikes will also be located on the maps as available road-building material.

Prof. H. F. Osborne of Columbia College, New York, came to North Carolina in May, 1894, and, without remuneration from the Survey, co-operated with the State Geologist in making an examination of the Egypt Coal Mine. And in June following, Mr. W. D. Matthews of Columbia College assisted further in this work, without remuneration from the Survey.

PUBLIC ROAD IMPROVEMENT.

In the investigation of materials suitable for road-building purposes the State Geologist has been assisted by Messrs. W. L. Spoon, J. V. Lewis, H. B. C. Nitze and Arthur Keith, each of whom has furnished data concerning the materials suitable for this purpose

found in the regions in which he has been at work. While the hard and dense black diabase of the trap dikes found crossing the sandstone and adjacent regions in middle North Carolina is undoubtedly the most durable road-building material yet found or likely to be found in the State, yet there have been found in middle and Piedmont counties—and to a less extent in the mountain counties—many ledges of stone which will be found fairly satisfactory for this purpose. In the eastern counties, and especially in the counties along the boundary between the eastern and midland sections—as in Northampton, Halifax, Franklin, Nash, Wilson, Johnston, Chatham, Harnett and Richmond—there are extensive deposits of gravel and gravelly loam which will prove of great value as a material for surfacing roads. In still other areas the coarse sands when mixed with local clays have been found to make hard and firm road surfaces. If wide tires could be generally used on all the wagons and carts of such regions, these sand-clay roads would be fairly permanent, and would require but little work for keeping them in repair. At a later date there will be published a special report embodying all available data concerning these road-building materials and how they may be used to the best advantage.

COASTAL PLAIN WORK.

The State Geologist has continued his field investigations of the geological formation of the eastern counties during the present season, more especially in the region of the Cape Fear river and its tributaries. He has also continued his examinations of the building stone deposits in the midland counties of the State. He has inaugurated an examination of the water-powers of the State, and as far as possible has co-operated with all other persons prosecuting such work for the Survey.

In examining the geological formations of the coastal plain region with reference to the possible supplies of under-ground or artesian waters, the State Geologist has followed the courses of the Roanoke, Tar and Cape Fear rivers from the fall line or head of navigation on each river to its mouth, examining and photographing the bluffs and the regions adjacent to the stream. As a result of these examinations, information has been furnished to many citizens of Eastern North Carolina as to the possibilities of their obtaining supplies of artesian water and the depth at which such waters might be obtained.

STREAM MEASUREMENTS.

A new line of work has been started during the past year, which is the investigation of the streams, in regard to the amount of water that they contain at various times throughout the year and their available water-powers. The co-operation has been obtained of the Division of Hydrography of the United States Geological Survey, and it is hoped that at an early date a bulletin can be published relating to the value and distribution of the water-powers throughout the State.

It is now proposed that through the co-operation of the State and Federal Geological Survey stations may be established at one or more points on each of the more important rivers; and that at each such station a competent observer shall be employed to measure and record the height of water in the stream each day in the year. At intervals of approximately once each month each of these stations will be visited by an engineer, who will measure accurately the volume of water in the stream at that time and place and the rate of flow of the water. From this data the volume of water flowing down the stream channel and the power it would develop for each foot of fall can be easily determined. The necessity for these frequent measurements becomes apparent when it is understood that before deciding on the development of any given water-power the capitalist must know the volume of water, and hence the power that can be depended upon at any and all seasons of the year—the minimum power at the dryest season of the dryest year, and at all other stages of the stream up to the highest flood. The data which it is proposed to obtain in the manner indicated will enable the manufacturer to determine in advance the power he may reasonably expect for each month of the year, and the extent of the supplemental steam plant he may need in order to enable him to utilize to the best advantage all the power of the stream even at ordinary high water stages.

In the office work of the Geological Survey assistance has been rendered at different times by the following persons: Mr. C. A. White and Mr. H. E. C. Bryant in general clerical work; Messrs. A. B. Kimball, M. M. Smith, J. C. Dudley and J. W. Cobb, and Misses I. L. Watson and E. Shiver served at intervals as stenographers. The names of other persons temporarily employed as office or field